US006205474B1

(12) **United States Patent**
Hurley

(10) **Patent No.: US 6,205,474 B1**
(45) **Date of Patent: *Mar. 20, 2001**

(54) **ACCESS MECHANISM FOR PARALLEL STATUS UPDATE FOR MULTIPLE SERVERS**

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(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/060,066**

(22) Filed: **Apr. 14, 1998**

(51) **Int. Cl.**[7] **G06F 15/16**

(52) **U.S. Cl.** **709/218**; 709/203

(58) **Field of Search** 709/218, 203, 709/105, 201, 219

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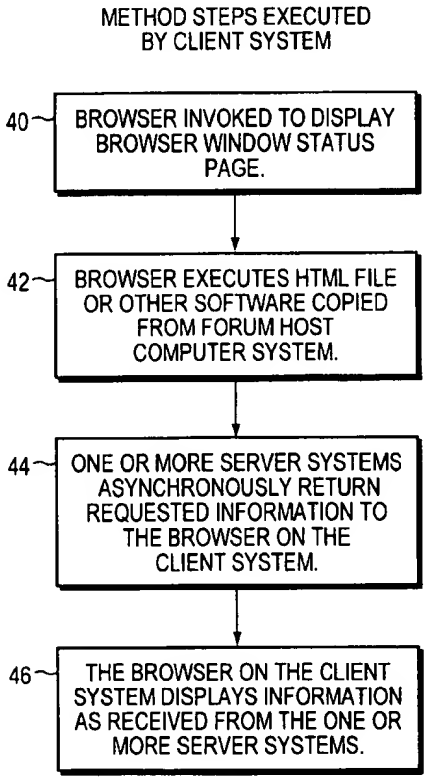
(74) *Attorney, Agent, or Firm*—Ceasari & McKenna

(57) **ABSTRACT**

Techniques used in obtaining information in parallel from one or more server systems as requested by a client computer system are disclosed. Multiple requests for information from one or more server systems are made in parallel providing information to the client system asynchronously rather than using a sequential synchronous programming technique.

17 Claims, 10 Drawing Sheets



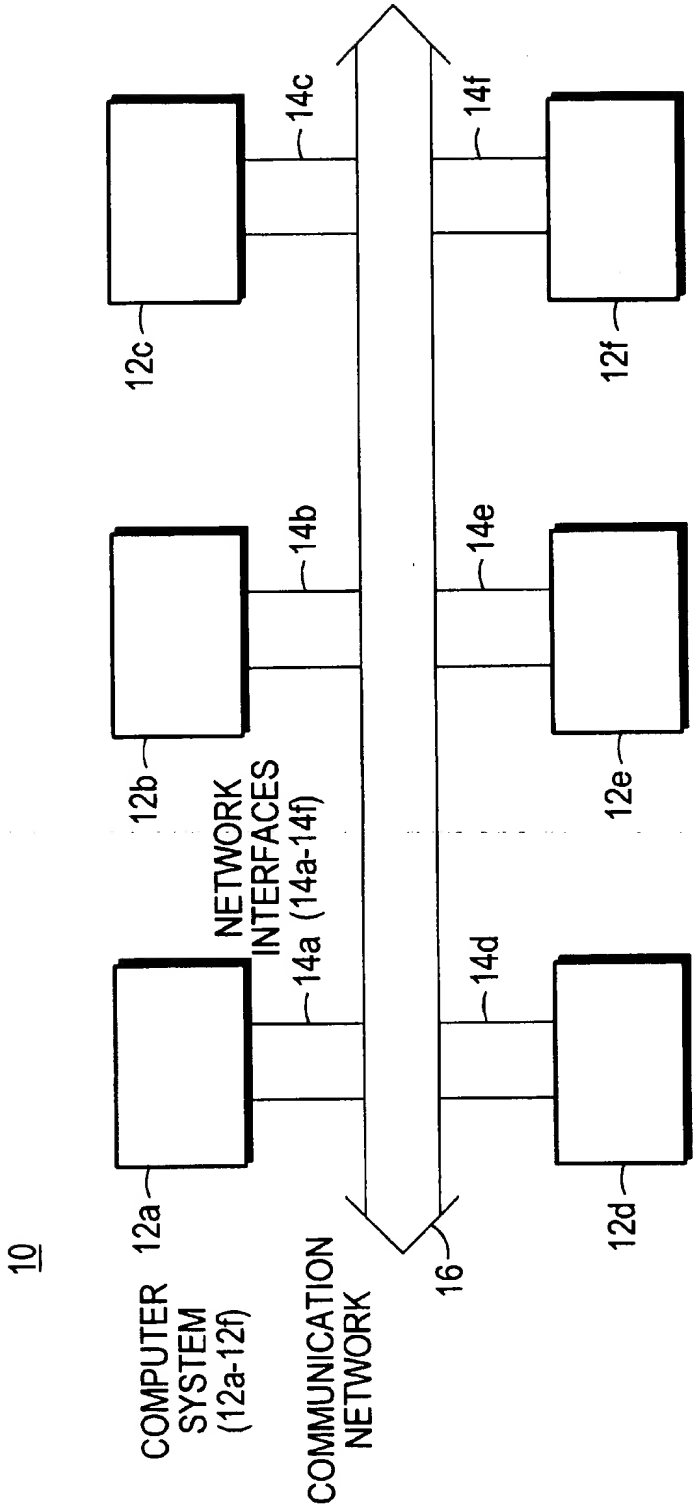

10
COMPUTER SYSTEM (12a-12f)
12a
12b
12c
12d
12e
12f
NETWORK INTERFACES
14a (14a-14f)
14b
14c
14d
14e
14f
16
COMMUNICATION NETWORK

FIG. 1

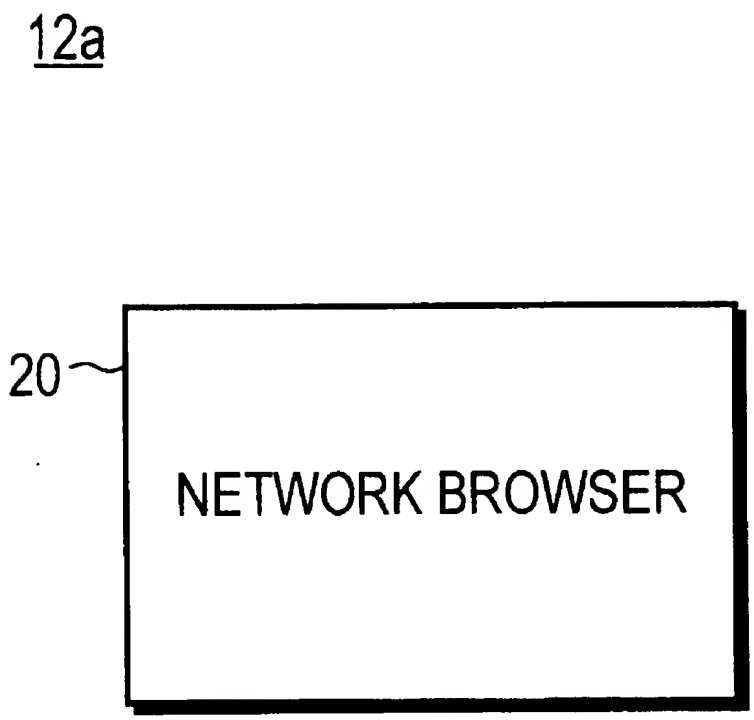


FIG. 2A

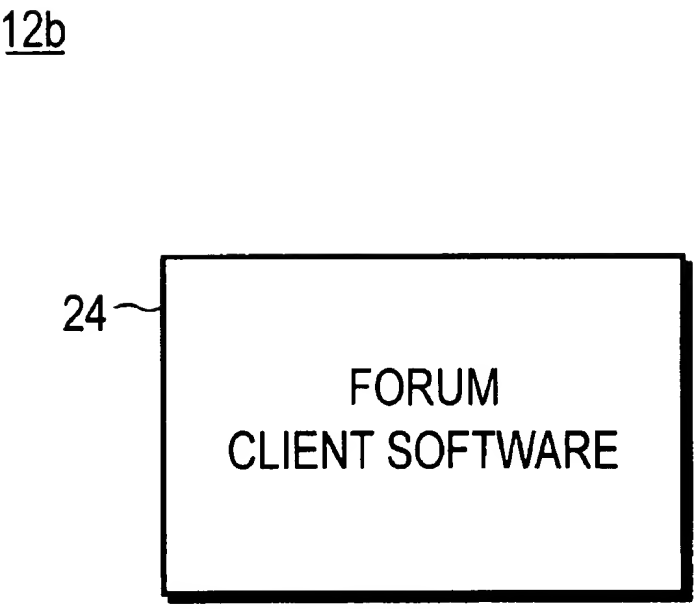


FIG. 2B

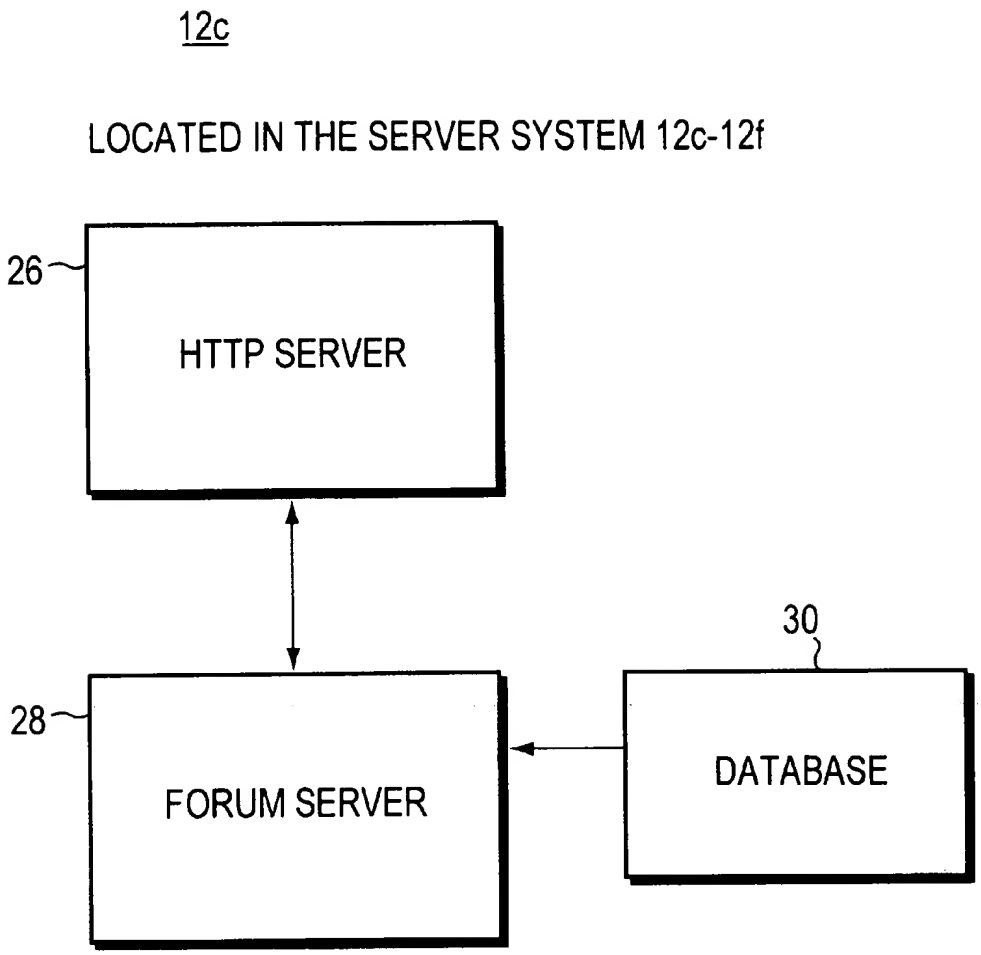

12c
LOCATED IN THE SERVER SYSTEM 12c-12f
26
HTTP SERVER
30
28
FORUM SERVER
DATABASE

FIG. 3

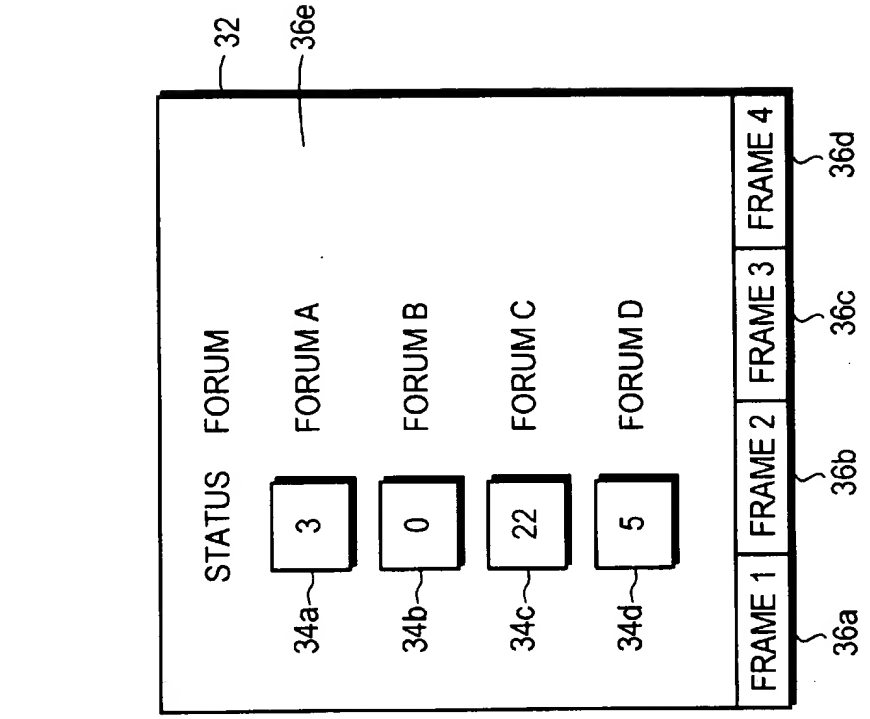


FIG. 4

22

EXECUTING USER PROCESS 22 INCLUDES THIS STATUS PAGE AS DISPLAYED ON DISPLAY DEVICE

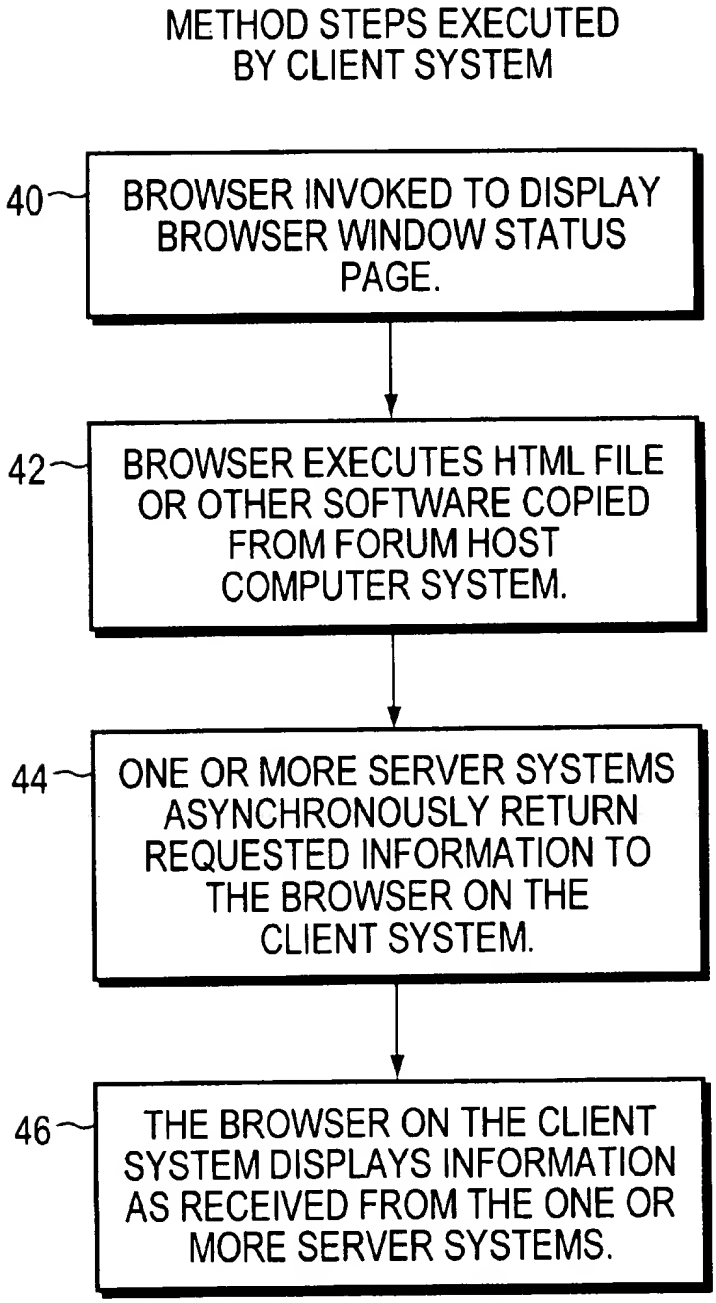

METHOD STEPS EXECUTED BY CLIENT SYSTEM
40
BROWSER INVOKED TO DISPLAY BROWSER WINDOW STATUS PAGE.
42
BROWSER EXECUTES HTML FILE OR OTHER SOFTWARE COPIED FROM FORUM HOST COMPUTER SYSTEM.
44
ONE OR MORE SERVER SYSTEMS ASYNCHRONOUSLY RETURN REQUESTED INFORMATION TO THE BROWSER ON THE CLIENT SYSTEM.
46
THE BROWSER ON THE CLIENT SYSTEM DISPLAYS INFORMATION AS RECEIVED FROM THE ONE OR MORE SERVER SYSTEMS.

FIG. 5

42 DETAIL SUBSTEPS OF STEP 42

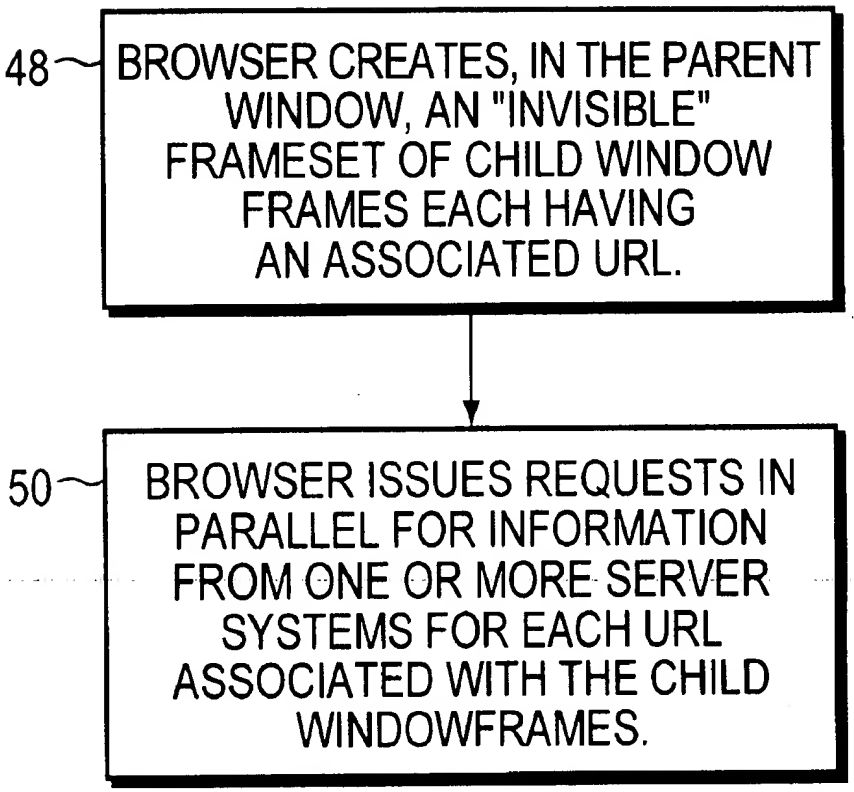


FIG. 6

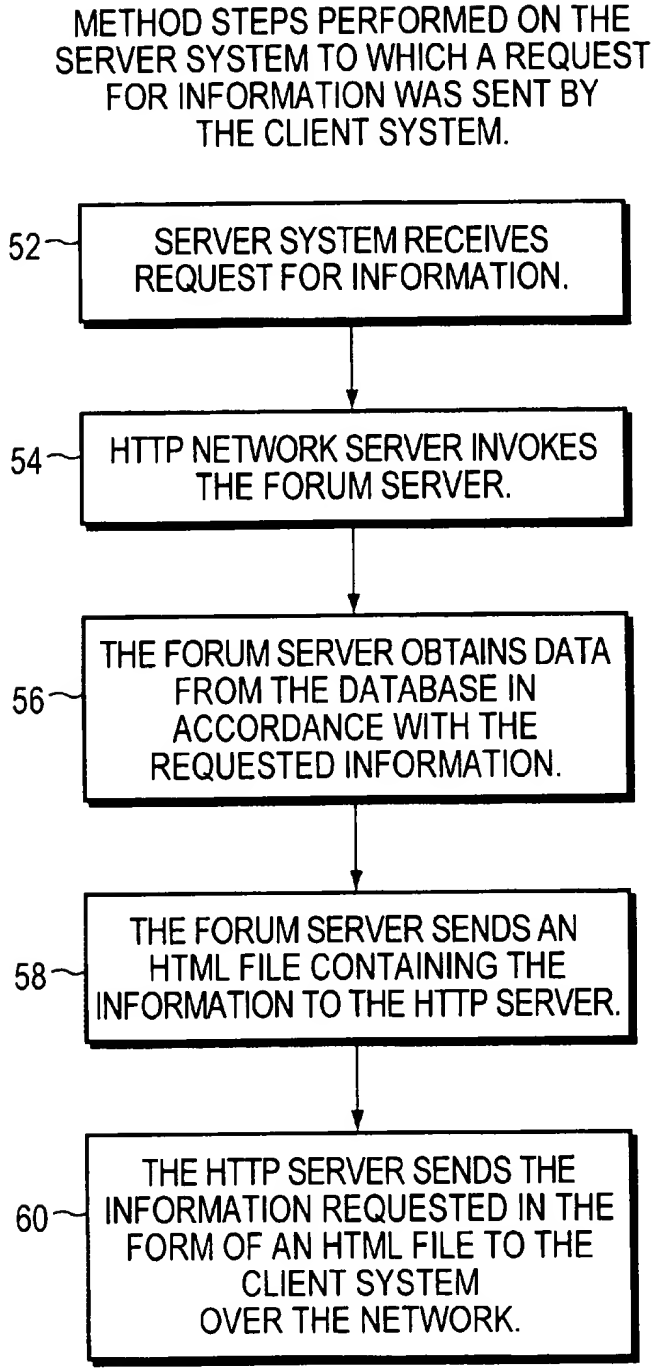

METHOD STEPS PERFORMED ON THE SERVER SYSTEM TO WHICH A REQUEST FOR INFORMATION WAS SENT BY THE CLIENT SYSTEM.
52
SERVER SYSTEM RECEIVES REQUEST FOR INFORMATION.
54
HTTP NETWORK SERVER INVOKES THE FORUM SERVER.
56
THE FORUM SERVER OBTAINS DATA FROM THE DATABASE IN ACCORDANCE WITH THE REQUESTED INFORMATION.
58
THE FORUM SERVER SENDS AN HTML FILE CONTAINING THE INFORMATION TO THE HTTP SERVER.
60
THE HTTP SERVER SENDS THE INFORMATION REQUESTED IN THE FORM OF AN HTML FILE TO THE CLIENT SYSTEM OVER THE NETWORK.

FIG. 7

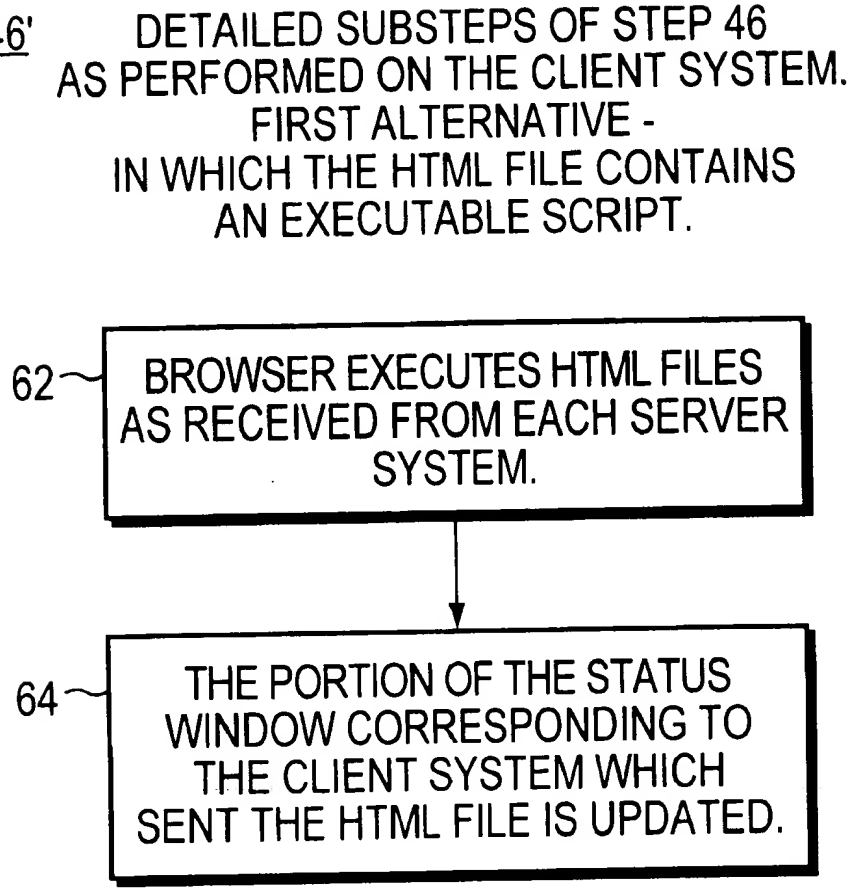

46'
DETAILED SUBSTEPS OF STEP 46 AS PERFORMED ON THE CLIENT SYSTEM. FIRST ALTERNATIVE - IN WHICH THE HTML FILE CONTAINS AN EXECUTABLE SCRIPT.
62
BROWSER EXECUTES HTML FILES AS RECEIVED FROM EACH SERVER SYSTEM.
64
THE PORTION OF THE STATUS WINDOW CORRESPONDING TO THE CLIENT SYSTEM WHICH SENT THE HTML FILE IS UPDATED.

FIG. 8

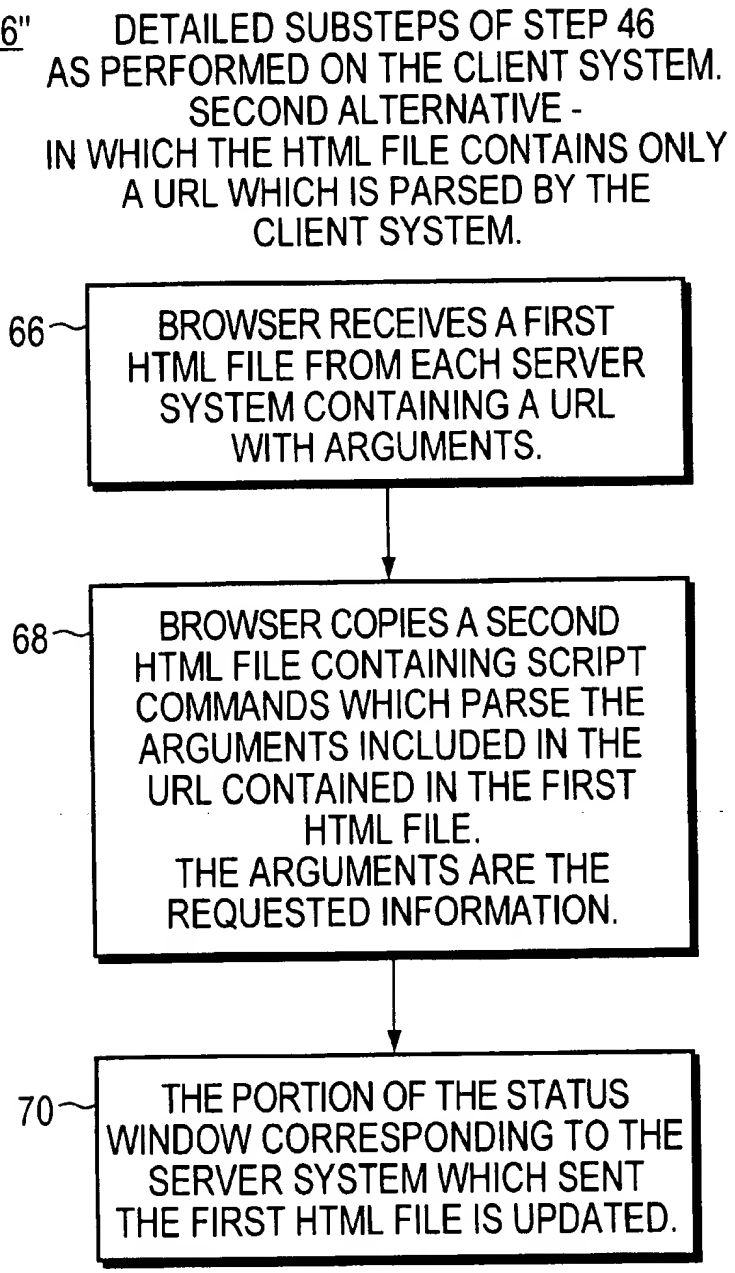

46" DETAILED SUBSTEPS OF STEP 46 AS PERFORMED ON THE CLIENT SYSTEM. SECOND ALTERNATIVE - IN WHICH THE HTML FILE CONTAINS ONLY A URL WHICH IS PARSED BY THE CLIENT SYSTEM.
66
BROWSER RECEIVES A FIRST HTML FILE FROM EACH SERVER SYSTEM CONTAINING A URL WITH ARGUMENTS.
68
BROWSER COPIES A SECOND HTML FILE CONTAINING SCRIPT COMMANDS WHICH PARSE THE ARGUMENTS INCLUDED IN THE URL CONTAINED IN THE FIRST HTML FILE. THE ARGUMENTS ARE THE REQUESTED INFORMATION.
70
THE PORTION OF THE STATUS WINDOW CORRESPONDING TO THE SERVER SYSTEM WHICH SENT THE FIRST HTML FILE IS UPDATED.

FIG. 9

ACCESS MECHANISM FOR PARALLEL STATUS UPDATE FOR MULTIPLE SERVERS

BACKGROUND OF THE INVENTION

This invention generally relates to computer networks. More specifically, this invention relates to a method and apparatus for retrieving information in a computer network.

The wide spread use of computer systems has prompted the development of many types of computer networks which allow multiple computer systems to communicate with each other. One significant computer network that has recently become very popular is known as the Internet. The Internet grew out of the use of computers and networks and has since evolved into a very sophisticated worldwide network of computer systems.

For a network connection and communication between two computers to be established, the two computers must be able to "speak" a common language. In other words, the two computers must be able to understand or use a common communication protocol. On the Internet (i.e., Web), this common language is the "hypertext transfer protocol" (HTTP).

A user on a computer system typically accesses the Internet using a software application known as a "Web browser". Generally a Web browser is a client application (Web client) executing in a computer system that enables a network connection, via the Internet, to other computer systems. Typically, the Web browser establishes an Internet network connection with another computer system generally known as a "Web server". Generally, a Web client sends HTTP requests to a Web server that returns pages of information typically in the form of text displayed in a format known as "hypertext markup language" (HTML). The Web browser receives the information as HTML pages from the Web server. In turn, the Web browser interprets the information provided in any received HTML pages, and subsequently displays the information on the user's computer system or terminal.

To locate information in a network, an addressing mechanism is needed. To facilitate locating Web pages on a particular computer system in the Internet, HTTP and HTML use an addressing mechanism known as a "uniform resource locator" (URL) to identify an Internet resource. A URL typically includes a portion of the address specifying the Web server computer system and then a path on that Web server leading to the resource or a relevant directory for that resource.

Generally, Web pages may contain static and dynamic data. Generally static data is data on a page that remains the same regardless of who accesses the data or when it is accessed. More recently, Web pages include dynamic data which is data on certain portions of the page that is subject to change. For example, dynamic data includes displaying stock market statistics or other data that may change periodically.

In some applications a user on one computer system using the Internet may require access to several pieces of dynamically changing data on one or more different Web server computer systems. For example, a user's Web browser in a first computer system may be interpreting an HTML file which requires five pieces of dynamic information from five different Web servers also connected to the user's system via the Internet. For uses such as this, a technique is needed which provides the updated information as needed from the multiple server nodes.

One technique used is to have the user's browser sequentially and synchronously contact each server node and await

information from each of the multiple servers. In other words, a Web client issues a first request for first information from a first Web server. The Web client synchronously waits for this information to be returned. Subsequently, the Web client issues a second request for second information from a second Web server, and so on, until all information has been received by the Web client.

This technique has a drawback of being a very lengthy process in which each server is contacted in serialized, sequential order. To request additional information from a subsequent server, the client first receives information as requested from the previous server. Depending upon the number of Web servers to be contacted for the pieces of dynamic information, the total amount of time to obtain this information and display it to a user is generally not acceptable for interactive use.

A second technique used when multiple pieces of dynamic information are to be gathered from servers on a network, such as the Internet, involves designing an application, such as a Web page, such that no piece of dynamic information is automatically obtained from a server system. In other words, a user manually selects each particular piece of dynamic information to be obtained rather than designing a Web page, as in the first technique, which automatically issues multiple requests serially for dynamic data. Using this second technique, the cost of obtaining dynamic information, in terms of computer time and resources, is incurred on an "as needed" basis based upon user selection. This is an improvement over the first technique in that the overhead is not automatically incurred. However, it is not suitable for use in all types of applications. Additionally, when multiple requests are made by a user for multiple pieces of dynamic data, the same sequential process of the first technique is used thereby incurring the same drawbacks of the first technique.

Thus there is required an efficient technique for obtaining information in a computer network, such as the Internet, in an automated fashion while minimizing the total amount of time and computer resources required to obtain the information.

SUMMARY OF THE INVENTION

In accordance with principles of the present invention, a technique is used for gathering information in a client-server system which takes advantage of the parallelism capabilities of a network browser. In accordance with one aspect of the invention is a method for providing information to a client system in a network. The method includes issuing requests for information, in parallel and using a network browser, to one or more server systems in a network, and subsequently returning the information to the client system.

Thus, there is provided an efficient technique for obtaining information in a computer network in an automated fashion while minimizing the total amount of time and computer resources required to obtain the information.

BRIEF DESCRIPTION OF THE DRAWINGS

The above mentioned and other features of the invention will now become apparent by reference to the following descriptions taken in conjunction with the accompanying drawings in which:

FIG. 1 is an example of an embodiment of a computer system;

FIG. 2A is an example of a client computer system in a network of FIG. 1;

FIG. 2B is an example of software located on a host computer system in the computer network of FIG. 1;

FIG. 3 is an example of the processes executing in a server system of the network of FIG. 1;

FIG. 4 is an example of a status page as displayed on a display device in the client's system of FIG. 1;

FIG. 5 is a flowchart depicting method steps of one embodiment as executed by the client system in FIG. 1;

FIG. 6 is a flowchart of an embodiment of more detailed substeps of step 42 from FIG. 5 in which the browser interprets an HTML file copied from a FORUM host computer system;

FIG. 7 is a flowchart of an embodiment of a method performed on a server system of FIG. 1 to which a request for information is sent by the client system;

FIG. 8 is a flowchart of a first alternative embodiment of a method depicting more detailed substeps of step 46 from FIG. 5; and

FIG. 9 is a flowchart of a second alternative embodiment of a method of more detailed substeps of step 46 from FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, an embodiment of a network **10** is shown to include a plurality of host computers, **12***a*–**12***f*, connected by a communication network **16**. Each of the computer systems **12***a*–**12***f* interfaces with the communication network **16** via a network interface, respectively **14***a*–**14***f*.

Each of the computer systems **12***a*–**12***f* may be one of many different types of computer systems including, for example, a personal computer to a large mainframe operating as separate computer system in the network **10**. Each of the computer systems **12***a*–**12***f* communicates with another computer system within the network **10** using communication network **16**.

It should be noted that a different number and arrangement of computer systems may exist in other preferred embodiments of the computer network **10**.

Referring now to FIG. 2A, shown is a process or task which is typically executing in a client system, as in node **12***a* of the computer network **10** of FIG. 1. FIG. 2A includes a network browser **20**. In the description that follows, node **12***a* will be referred to as the client system, for example, in which a user typically invokes a windows programming application like a network browser **20**, such as the Microsoft Internet Explorer or the Netscape browser. The client computer system **12***a* is a computer system that is usually serviced by one or more server computer systems also included in the network **10**. In the preferred embodiment which will be described in paragraphs that follow, the network **10** is the World Wide Web (WWW) or Internet. It should be noted that in other preferred embodiments, different internets or intranets may also exist.

A user may execute a Windows application, such as network browser **20**, to communicate with other Web sites, such as computer systems **12***b*–**12***f* in the computer network **10**. Generally a network browser **20** is software that interprets and presents hypertext mark-up language (HTML) documents to users of a computer system. A browser generally obtains, renders and displays data and other information to a user. Frequently, data items and files displayed by the network browser **20** reside on another computer in the network **10** other than the computer running the browser. It is at this point that the browser communicates with other computer systems in the computer system via computer network **16** to obtain required data and other information by sending information requests.

Generally, a document file received by the client system is an HTML document file that includes commands and other information. The commands are interpreted by the network browser **20** to perform certain operations and obtain certain pieces of data in accordance with commands included in an HTML file. Typically, the HTML files exist on a computer system other than the client **12***a* also in the network **10**. However, in other preferred embodiments the HTML files may exist on the client computer system **12***a*.

One application which makes use of a network browser **20** is a status tool, as included in Alta Vista FORUM™ (AVF). Generally AVF is a collaboration product providing users, such as one executing web browser **20** in computer system **12***a*, status information from multiple server nodes, such as nodes **12***b*–**12***f* of the network **10**. AVF provides update and status information, for example, regarding electronic notes conferences. As known to those skilled in the art, an electronic notes conference is typically an electronic bulletin board which resides on a computer system in a network **10**. Users enter replies and other forms of electronic text and documents in the notes conference. Subsequently, this information is communicated to other users of the notes conference. Thus, the notes conference serves as a means of communication between users of the notes conference in which the users may reside on different computer systems, such as **12***a*–**12***f* in the network **10**.

Using the AVF product, a user of a notes conference invokes the network browser **20** to provide status information as to various notes conferences in which the user participates. Status information may include, for example, how many new notes and replies have been entered since the user last accessed the notes conference. The various components of the AVF product and where they reside will be described in paragraphs that follow.

Referring now to FIG. 2B, shown is an example of an embodiment of the software included on an AVF host system. In this description, the AVF host system is node **12***b* of the network **10**. Located on the node **12***b* is the FORUM client software **24**. Generally the FORUM client software **24** includes various software components which allow a client, such as browser **20** executing in computer system **12***a* as shown in FIG. 2B, to access necessary notes conference status information. Typically, the FORUM client software **24** includes HTML files which are downloaded to the client system, such as node **12***a*, for execution or interpretation, for example, by network browser **20** to provide the necessary status information to the client.

It should be noted that other preferred embodiments may include other software in the FORUM client software **24** to be used in conjunction with, or as a replacement for, the previously described HTML files. Additionally, the FORUM client software **24** may include generated and/or non-generated software, which varies with implementation. Generally, generated software is that which is dynamically produced or generated when needed. In contrast, non-generated software is static, and generally stored and retrieved when needed rather than being produced dynamically. In our embodiment, the HTML files, as included in the FORUM client software **24**, are non-generated HTML files.

It should also be noted that although the FORUM client software **24** is located on a AVF host system **12***b* which is a different computer system than the client system **12***a*, in

other preferred embodiments, nodes **12***a* and **12***b* may be the same computer system.

Referring now to FIG. **3**, shown is an example of an embodiment of the software which executes on the various server systems, such as **12***c*–**12***f*, which provide various status information to the client system, such as node **12***a*. In this preferred embodiment, nodes **12***c*–**12***f* each contain at least one notes conference to which a user identifier associated with the user of browser **20** is a member or participant. In other preferred embodiments, each server may contain a varying number of conferences or other resources requested by the client system. Each of these server systems **12***c*–**12***f*, which is a server with respect to the AVF product, includes an HTTP server **26**, a FORUM server **28**, and a database **30**. Generally, the HTTP server **26** is software that communicates over the communication medium with other software applications, such as the network browser **20** of FIG. **2**A executing in the client system.

Typically, a data request is made by client system through the network browser **20**. This data request is communicated over communication network **16** to other various server systems, such as **12***c*–**12***f*, which include an HTTP server **26**. In turn the HTTP server **26** communicates with other server components of the AVF product.

It should be noted that in this particular embodiment, the communication medium **16** is the Internet or WWW. Accordingly, the server system includes an HTTP server **26** since this is the communications protocol typically associated with the Internet. If another network or intranet is included in another preferred embodiment, the server on the server systems may not be an HTTP server. This varies with the particular configuration and embodiment.

As shown in FIG. **3**, the AVF product also includes a FORUM server **28** located on each of the server systems **12***c*–**12***f*. Generally the FORUM server **28** is software invoked by the HTTP server when the HTTP server recognizes that a request has been made for a notes conference whose status is provided by the AVF product. As known to those skilled in the art, one mechanism by which the HTTP server invokes or recognizes that a request has been made for the FORUM server **28** is through the use of dispatch tables or other call-back mechanisms in accordance with implementation. Generally, these mechanisms invoke a particular executable image on the server system **12***c* in accordance with specific information communicated to the FORUM server **28** in the data request from the client system **12***a*. In this preferred embodiment, the FORUM server retrieves information from the data base **30** and returns information to the HTTP server **26**. The HTTP server, in turn, communicates the information to the network browser **20** in the client computer system **12***a* using the communication network **16**.

Information provided by the FORUM server **28** may be generated or non-generated information. Typically, non-generated information is information supplied by performing, for example, a database look-up and returning information stored in one or more records of the data base **30**. In contrast, generated information is information supplied which is, for example, dynamically generated based on parameters communicated to server system **12***c* from client system **12***a* for the particular data request. In other words, rather than return a copy of a record from database **30** (non-generated information), data may be obtained from database **30** in accordance with a parameters included in a data request. Subsequently, the FORUM server **28** dynamically generates a data file such as an HTML file to perform certain commands based on the data obtained from database **30**. In one preferred embodiment, this data generation may be done each time a data request is made from a client system such as **12***a*.

As known to those skilled in the art, when using the Internet as a communication network **16**, resources are located on each of the various nodes and identified by a uniform resource locator (URL). Generally, a URL specifies an Internet location of a Web document such as an HTML document. A URL may be analogous to an electronic mailing address of an Internet resource, such as an HTML file. A URL has a predetermined format or syntax specifying an Internet protocol (IP) address and the various machine executable image or data file being accessed on a particular node or computer system with the specified IP address. An example of a URL is:

```
http://nodename.com/file_to_access
```

in which "nodename" is the name of the computer system to which the request is made, and "file_to_access" is, for example the name and location of the HTML to be sent to the requesting client system.

Additional information, such as commands, arguments, and the notes conference name in this particular embodiment may be passed as additional parameters in the URL which are ignored by some software components, such as the HTTP server, and further passed on to other pieces of software such as the FORUM server. In other words, there are portions of the formatted URL which contain information interpreted by different pieces of software, such as servers. Other portions of the URL are passed to subsequent pieces of software, such as the FORUM server **28**, to be used locally by the application being invoked on a various server system. For example, the above URL may be modified to include an appended string on the right-hand side. The string includes arguments which are not processed by the HTTP server, but are included in the data passed to other software on, for example, the client system. The URL may be:

```
http://nodename.com/file_to_access#arg1, arg2, . . .
```

in which the "#" and data to the right is processed by other software on the client system and not interpreted when fetching a particular data file in accordance with the other URL information. This will be described in more detail in paragraphs that follow, in particular with reference to FIG. **9**.

Referring now to FIG. **4**, shown is an example of an embodiment of a status page as displayed on a display device when executing network browser **20** in computer system **12***a* of the network **10**. Execution of the network browser **20** causes a status page **32** to be displayed on a display device. The status page provides update or status information on various notes conferences or forums in which a particular user participates. In this example, status page **32** includes an upper portion **36***e* providing status information on four notes conferences or forums. The notes conferences or forums are identified on the right-hand side of status page **32** as FORUMS A through D. Corresponding status information is displayed on the left-hand side of status page **32**, as identified by elements **34***a*–**34***d*, respectively, for each of the corresponding notes conferences. Included at the bottom of the display page **32** are four frames, **36***a*–**36***d*. Each of these frames may be viewed as a child frame or sub-frame with a child/parent relationship with the remain-

der 36E of the status display window **32**. In other words, frames 1 through 4 (**36***a*–**36***d*) have a parent window or a parent frame **36***e*. As will be described in paragraphs that follow, each of the frames **36***a*–**36***d* is responsible for updating a corresponding portion **34***a*–**34***d*, respectively, of the status page located in the parent frame **36***e*.

It should be noted that although frames 1 through 4 (**36***a*–**36***d*) are shown as being visible in FIG. **4**, in a preferred embodiment these child frames may be "invisible" by having a height of zero such that no child frames **36***a*–**36***d* are displayed on the status window to a user.

Referring now to FIG. **5**, shown are the method steps of one embodiment of a method executed in a client system **12***a* for a user to obtain the status display page as shown in FIG. **4**. The method of FIG. **5** generally issues requests for necessary information to supplied about the various notes conferences or forums. At step **40**, a browser is invoked to display the browser window status page. When this occurs, the browser executes an HTML file copied from an AVF host computer system having the client software at step **42**. With reference to prior figures, the network browser **20** located on computer system **12***a* of FIG. **2**A, is invoked and retrieves from the FORUM client software **24** resident in the AVF host system **12***b*. Included in this FORUM client software is the HTML file which is interpreted by the network browser **20** to display a status page **32** such as shown in FIG. **4**.

At step **44**, subsequent to the HTML file being copied and interpreted by the browser, one or more server systems asynchronously return requested information to the client system. With reference to prior descriptions and figures, the one or more server systems (**12***c*–**12***f*) return information to the client system **12***a* when the network browser **20** interprets the HTML file copied from the AVF host computer system **12**B. In step **46**, the browser on the client system displays information as received from the one or more server systems. It should be noted that in step **44**, one or more server systems asynchronously return requested information. Accordingly, the browser on the client system displays this information as it is received from the one or more server systems. For example, regarding status display page **32** from FIG. **4**, if four requests for information were issued to four different nodes in the network **10**, each of them would return different information as to the status of the various notes conferences or forums accessed by the particular user. As each node or computer system returns information regarding a particular notes conference, the display page **32** is accordingly updated.

Referring now to FIG. **6**, shown is an example of an embodiment of the detailed substeps of step **42** from FIG. **5** in which the HTML file(s) copied from the AVF host computer system are interpreted by the network browser **20**. Commands included in the HTML file as interpreted by the browser cause the browser to perform the method steps **48** and **50**.

Referring now to step **48**, the browser creates in the parent frame an invisible frame set of child window frames each having an associated URL. An example of these child window frames of step **48** are described in preceding paragraphs referring back to frames 1–4 (**36***a*–**36***d*) of FIG. **4**. Each of frames 1 through 4 (**36***a*–**36***d*) has an associated URL, as specified in commands included in the HTML files. Interpretation of these particular HTML commands by the browser causes the browser to issue, as in step **50**, requests in parallel for information from the one or more server systems for each URL associated with the child window frames. Each URL designates a resource on a corresponding one of the server systems (**12***c*–**12***f*). Each server system returns requested information asynchronously which is subsequently displayed on the status display page **32** of FIG. **4**, as per previously described step **44**.

It should be noted that step **50** makes use of the parallelism capability typically available in a network browser. The network browser can make multiple information requests from one or more servers simultaneously by taking advantage of the characteristics of the frame feature typical of an HTML file as executed by a network browser. As known to those skilled in the art, to accomplish the same effect, an alternate implementation also taking advantage of the parallelism capability in a network browser includes having multiple embedded Applets in the HTML code being executed in a single window or frame. Generally, Applets are portions of executable code or script which are executed in a user's system when the user is executing an HTML file located on another server system.

Referring now to FIG. **7**, shown is a flowchart of an embodiment of a method performed on a server system to which a request for information is sent by the client system. The method step depicted in FIG. **7** are typically executed on a server system, such as **12***c*–**12***f*, with reference to the previously described embodiment. In step **52**, a server system receives a request for information as sent by a client computer system. In step **54**, the HTTP network server invokes the FORUM server. Recall that both the HTTP network server and FORUM server were shown and described in conjunction with FIG. **3**. At step **56**, the FORUM server obtains data from the database in accordance with the requested information. At step **58**, the FORUM server sends an HTML file containing the information requested to the HTTP server. Recall, as previously described, that the HTML files returned to the HTTP server from the FORUM server in step **58** may be generated or non-generated files based on information from the database **30**. At step **60** the HTTP server communicates this returned information requested in the form of an HTML file to the client system over the communication network **16**.

Referring now to FIG. **8**, shown is a flowchart of a first preferred embodiment of a method showing more detailed substeps of step **46** of FIG. **5** in which the browser on the client system displays information received from one or more server systems. The method steps of FIG. **8** update status display information by executing HTML commands returned to the client system from the one or more server systems. Referring now to step **62**, the browser executes the HTML files as received from each server system. At step **64**, the portion of the status window corresponding to the client system which sent the HTML file is updated. Referring back to FIG. **4**, each of the child window frames **36***a*–**36***d* corresponds to a particular status box, **34***a*–**34***d* respectively. Thus when information is received by the client system, for example, as designated by the URL associated with frame 1 **36***a*, the status box **34***a* is accordingly updated.

Referring now to FIG. **9**, shown is a flowchart of a second preferred embodiment of a method of more detailed substeps of step **46** of FIG. **5**. Generally the steps of FIG. **9** depict a method of updating the status window in which the HTML file received by each client system specifies a URL of a second HTML file with local arguments.

In step **66**, the browser receives a first HTML file from each server containing commands specifying a URL of a second HTML file with other local arguments, as previously described. At step **68**, the browser copies the second HTML file which contains script commands that parse the arguments included in the URL returned in step **66**. The arguments are the requested information. At step **70**, the portion

of the status window corresponding to the server system which sent the first HTML file is accordingly updated.

Generally at step **68** execution of the second HTML file results in parsing the URL contained in the first HTML file to remove those local arguments included in the URL which are the requested information. This requested information is accordingly displayed as a result of Step **70** of FIG. **9**.

In this preferred embodiment, the second HTML file is non-generated and the same file may be used for each of multiple requests that are made (i.e., when the method steps of FIG. **9** are executed multiple times). When such multiple requests are made, as a performance enhancement, browsers in a preferred embodiment may cache the second HTML file for subsequent use after the first time it is accessed and copied from system **12***b* to system **12***a*. Typically, browsers include this caching feature as a user selected option.

It should be noted that two alternate embodiments are given for performing step **46**. This is due to the fact that in one particular implementation of the method steps of FIG. **8**, the implementation does not work with all network browsers. Rather that particular implementation of the method steps of FIG. **8** worked properly only with the restriction that the AVF host system **12***b* was the same as the server system **12***c*–**12***f*. If the AVF host system ever differed from the server system, such as **12***c*, the implementation would not execute properly. This is due to the fact that some network browsers, such as particular versions of the Internet Explorer, do not allow HTML code from one server running in a frame to execute a function residing in another frame that has HTML code from a different server. In other words to work properly, the URL of both the first and second frames must designate the same computer system. This will become more apparent to one of ordinary skill in the art by the sample HTML files provided in the following text. To overcome this restriction dependent upon particular system features, a preferred embodiment may alternatively use the method steps of FIG. **9**.

In following text are three sample HTML files: Pat_**0**, Pat_**1**, and Pat_**2** which contain various HTML commands to implement the method steps of FIG. **8**. With reference to the previously described embodiment, files Pat_**0**, Pat_**1**, and Pat_blank reside on the AVF host system such as node **12***b* described in conjunction with FIG. **2**B, and Pat_**2** resides on one of the servers such as nodes **12***c*–**12***f*.

Generally, Pat_**0** displays the parent frame which includes creating two child frames, each of which is associated with an HTML file Pat_**1**, and Pat_**2**, respectively. Interpretation of Pat_**0** by the browser causes two requests to be issued to the AVF host systems, as designated in the URLs specifying Pat_1 and Pat_2 (see FRAME SRC command below). These HTML files are subsequently copied to the client system from the AVF host system and executed in the client system. Interpretation of Pat_**1** causes a button to be displayed which, when activated by the user as by a right mouse click, causes HTML file Pat_**2** to be copied from the designated server system to the client system. Pat_**2** is then executed on the client system updating a portion of the parent window frame. Pat_**0** also includes a second request for Pat_**2** to be copied from the server system and executed on the client system. This second request is an automatic direct request in the file Pat_**0**, as opposed to waiting for user selection, as in the previously description of Pat_**1**.

```
File Pat_0:
<HTML>
<HEAD><TITLE> Frame Example 1 </TITLE>
<SCRIPT LANGUAGE="JavaScript">
<!--
////////////////////////////////////////////////
//
// Demonstration of retrieving data from multiple servers
// as directed from the client browser.
//
// This page is the parent frameset. It is initially loaded
// from any available server.
//
// Parent javascript functions are included here.
//
////////////////////////////////////////////////
function list() {
}
var answer = '';
var number = 0;
var timeId = null;
function storeData1() {
  pat1.document.pat1form.pat1text.value = answer;
  timeId = setTimeout('storeData1()',1000);
}
timeId = setTimeout('storeData1()',1000);
<!-- end script -->
</SCRIPT>
</HEAD>
<FRAMESET ROWS="60%,40%">
  <FRAME SRC="http://AVF_HOST/pat1.htm" NAME="pat1">
  <FRAME SRC="http://AVF_HOST/pat2.htm" NAME="pat2">
</FRAMESET>
</HTML>
File Pat_1:
<HTML>
<HEAD><TITLE> Frame Example 1 </TITLE>
<SCRIPT LANGUAGE="JavaScript">
<!--
function launchUrl() {
  parent.pat2.location ='http://SERVER/pat2.htm';
  parent.number++;
}
<!-- end script -->
</SCRIPT>
</HEAD>
<body>
<h2>Display Frame</h2>
This frames displays data received from the other servers.
<p>
<form name=pat1form>
<input type=text name=pat1text size=60>
<br>
<br>
<br>
<input type=submit value='Click here to fetch the current date
and time.' onClick='launchUrl()'>
</form>
</body>
</HTML>
File Pat_2:
<HTML>
<HEAD><TITLE> Frame Example 1 </TITLE>
<SCRIPT LANGUAGE="JavaScript">
<!--
var today = new Date();
var s ='The data gatherer computes today to be:';
s += today.getMonth() + 1;
s += '/';
s += today.getDate();
s += '/';
s += today.getYear() + 1900;
s += ''
s += today.getHours();
s += ':';
s += today.getMinutes();
s += ':';
s += today.getSeconds();
// Store the answer up onto the parent's page
```

-continued

```
self.parent.answer = s;
<!-- end script -->
</SCRIPT>
</HEAD>
<body>
<h2>Data Gatherer</h2>
This frame gathers the desired data and returns it to be displayed.
<p>
In this example, the URL loaded in this frame built a string containing
today's date and returned it to be displayed.
</body>
</HTML>
```

In following text included are five files: Pat_10, Pat_11, Pat_12, Pat_13, and Pat_blank which implement the method steps of FIG. 9 without the restriction previously described in conjunction with FIG. 8. Generally Pat_10, Pat_11, Pat_13 and Pat_blank reside on the AVF host system such as node 12*b* previously described, and the file Pat_12 resides on one of the server systems, such as nodes 12*c*–12*f*.

Generally, interpretation of Pat_10 by a browser creates the parent window and two child frames associated with two HTML files Pat_11 and Pat_blank. Requests are issued to the AVF host system for these HTML files which are copied to, and interpreted in, the client system. Interpretation of Pat_11 causes a button area to be displayed similar to that as displayed when Pat_1 is interpreted. When the button area is activated, as by a right mouse button click, a request for Pat_12 is sent to the server system (Pat_12 is the first HTML file in step 66 of FIG. 9). Pat_12 is copied to, and interpreted in, the client system. It should be noted that Pat_12 includes DATE and TIME information. The server system supplies values for this information which is sent to the client system. Interpretation of Pat_12 causes a second request to be issued to the AVF host system to supply Pat_13. (Pat_13 is the second HTML file in step 68 of FIG. 9). Interpretation of Pat_13 causes the URL designating Pat_13 to be parsed. In a URL format similar to what was previously described, the requested information of date and time are included as values to the right of the "#" (hash) symbol in the URL designating Pat_13. Accordingly, the text area in the parent window is updated. The file Pat_blank in this example doesn't cause anything to occur. However, in a typical use as described with status window 32, Pat_blank is replaced with a file similar to Pat_11 causing execution of the method steps of FIG. 9.

File Pat_10:

```
<HTML>
<HEAD><TITLE> Frame Example 1 </TITLE>
<SCRIPT LANGUAGE="JavaScript">
<!--
////////////////////////////////////////////////
//
// Demonstration of retrieving data from multiple servers
// as directed from the client browser.
//
// This page is the parent frameset. It is initially loaded
// from any available server.
//
// Parent javascript functions are included here.
//
// The mechanism used in this example is to pass the data
// received from a remote server as part of a URL, thus
// bypassing problems with inter-frame access permissions.
//
```

-continued

```
////////////////////////////////////////////////
<!-- end script -->
</SCRIPT>
</HEAD>
<FRAMESET ROWS="60%,40%">
  <FRAME SRC="http://AVF_HOST/pat11.htm" NAME="pat11">
  <FRAME SRC="http://AVF_HOST/pat_blank.htm" NAME="pat12">
</FRAMESET>
</HTML>
File Pat_11:
<HTML>
<HEAD><TITLE> Frame Example 2 </TITLE>
<SCRIPT LANGUAGE="JavaScript">
<!--
function launchUrl() {
  var host = self.location.host;
  var path = self.location.pathname;
  path = path.substring(0, path.lastIndexOf('/'));
  parent.pat12.location = 'http://SERVER/pat12.htm#' + host + path;
}
function storeData1 (answer) {
  self.document.pat11form.pat11text.value = answer;
}
<!-- end script -->
</SCRIPT>
</HEAD>
<body>
<h2>Display Frame</h2>
This frames displays data received from the other servers.
<p>
<form name=pat11form>
<input type=text name=pat11text size=70>
<br>
<br>
<br>
<input type=submit value='Click here to fetch the current date
and time.' onClick='launchUrl()'>
</form>
</body>
</HTML>
File Pat_12:
<HTML>
<HEAD><TITLE>Frame Example 2 </TITLE>
<SCRIPT LANGUAGE="JavaScript">
<!--
var today = new Date();
var s = '';
s += today.getMonth() + 1;
s += ',';
s += today.getDate();
s += ',';
s += today.getYear() + 1900;
s += ','
s += today.getHours();
s += ',';
s += today.getMinutes();
s += ',';
s += today.getSeconds();
// Send the answer back by launching a url on the original server and
passing
// the answer along in the 'hash' field
// First, get the url of the originator (from the hash field of our url)
var orgUrl = self.location.hash;
var orgLength = orgUrl.length;
orgUrl = orgUrl.substring(1,orgLength);
// Next, build the url to launch at the client
var url = 'http://' + orgUrl + '/AVF_HOST/pat13.htm#' + s;
self.location = url;
<!-- end script -->
</SCRIPT>
</HEAD>
<body>
</body>
</HTML>
File Pat_13:
<HTML>
<HEAD>
</HEAD>
<BODY>
```

-continued

```
<SCRIPT LANGUAGE="JavaScript">
function getNextField(str) {
        var nextField = str;
        var index = str.indexOf(',');
        if (index >= 0) {
            nextField = str.substring(0, index);
        }
        return nextField;
}
function cutNextField(str) {
        var newStr ='';
        var index = str.indexOf(',');
        if (index >= 0) {
            newStr = str.substring(index+1, str.length);
        }
        return newStr;
}
var hashValue = self.window.location.hash;
var index = hashValue.indexOf('#');
if (index >= 0) {hashValue = hashValue.substring(index+1,
hashValue.length)}
var day = getNextField(hashValue);
hashValue = cutNextField(hashValue);
var month = getNextField(hashValue);
hashValue = cutNextField(hashValue);
var year = getNextField(hashValue);
hashValue = cutNextField(hashValue);
var hours = getNextField(hashValue);
hashValue = cutNextField(hashValue);
var minutes = getNextField(hashValue);
hashValue = cutNextField(hashValue);
var seconds = getNextfield(hashValue);
hashValue = cutNextField(hashValue);
//Build the answer string
var s = "The data gatherer computed today's date as:"
s += day + '/' + month + '/' + year + ' ' +
hours + ':' + minutes + ':' + seconds;
//Now, store the answer into the parent so it can be displayed
parent.pat11.storeData1(s)
<!-- end script -->
</SCRIPT>
<body>
<h2>Data Gatherer</h2>
This frame gathers the desired data and returns it to be displayed.
<p>
```

It should be noted that various aspects of the foregoing descriptions may vary with implementation of the principals of the invention. For example, depending upon the particular network browser **20** residing on a client system **12***a*, either of method steps of FIG. **8** or FIG. **9** may be used.

The foregoing description affords a flexible and efficient technique for providing status information for one or more server computer systems in a network **10** by making use of the parallelism capabilities as included in a standard network browser. As previously described, the standard network browser can request multiple URL's of multiple servers simultaneously by using the frame feature included in the HTML file as interpreted by the network browser. Although the previously described embodiment provided status information with regard to forum or notes conferences, the principals of the invention may be more generalized to gather any type of information taking advantage of the parallelism of the browser using the standard HTML language FRAME feature to fetch data in parallel from one or more server systems. It should also be noted that although the previously described embodiment includes one or more server computer systems in which each of the requests are made from different computer systems, an alternate embodiment may makes requests of the same server computer system since the servers are typically multi-threaded. In other words, the same server may be queried multiple times in parallel by a single client computer system. Also known to those skilled in the art are other parsing techniques for retrieving information encoded in the URL of the second HTML file.

It should also be noted as known to those skilled in the art that various portions of the Alta Vista Forum product, such as the FORUM client software **24** of FIG. **2B**, may be implemented as a scripted language or a programming language. There are also various mechanisms, for example in the HTTP server, for invoking the appropriate software products on a server node which may vary with implementation. For example one version of an HTTP server may invoke a particular machine executable image for a particular request sent to a server computer system by placing the executable in a directory with a particular name. It should also be noted that the above files contained in the previous two examples function properly in accordance with Internet Explorer™ V4.0 and Netscape™ V4.0. Different versions and different configurations of software and hardware may require one skilled in the art to slightly modify the previously described files for working in a particular environment.

The foregoing description affords a flexible and efficient technique for gathering information by taking advantage of the parallelism capabilities of a browser using the standard HTML features for fetching data from various server computer system. By taking advantage of the parallelism available in a standard network browser. A more efficient alternative to sequential programming asynchronously waiting for each server system to return information exists.

Having described preferred embodiments of the invention, it will now become apparent to those skilled in the art that other embodiments incorporating its concepts being provided, it is felt that this invention should not be limited to the disclosed embodiment but rather should only be limited to the scope of the appended claims.

What is claimed is:

1. A method of providing information to a client system in a network, the network including one or more server systems, said method comprising the steps of:

issuing a plurality of requests for status information about a plurality of notes conferences to one or more of the server systems, said plurality of requests issued by means of a standard Hypertext Markup Language (HTML) language FRAME feature in a browser, said browser resident in the client system;

receiving one or more responses from the one or more server systems in response to said plurality of requests, each said response comprising at least a portion of the status information requested, said one or more responses received by said browser;

providing a parent frame in a display at the client system;

creating a frame set of child frames in said parent frame; and

providing each said portion of status information to said display, each said portion of status information provided to said parent frame in a sequence as received from the one or more server systems, each said child window frame for updating a portion of said status information.

2. The method of claim **1**, wherein the one or more server systems return said one or more responses asynchronously.

3. The method of claim **1**, further comprising the steps of:

contacting a network server in a first of said one or more server systems simultaneously with or subsequent to said step of issuing a plurality of requests;

invoking a program in said first server system via said network server;

retrieving at least a portion of the information requested from said network server via said program; and

returning at least one response to the client system, said at least one response comprising said retrieved information.

4. The method of claim **3**, wherein said invoked program is identified by a program identifier included in a first of said plurality of requests sent to said first server system, said invoked program located in a directory identified by said program identifier.

5. The method of claim **3**, wherein said step of retrieving at least a portion of the information requested from said network server comprises the step of:

retrieving data from a database via said program.

6. The method of claim **5**, wherein said at least one response comprises said data from said database.

7. The method of claim **5** further including the step of:

producing, using said data from said database, a generated file; and

returning said generated file to said network server to be further returned to said client system.

8. The method of claim **1**, wherein one of said one or more responses received by said browser comprises a first command file, and said method further comprises the steps of:

executing said first command file in the client system; and

updating said display in response to said step of executing said first command file.

9. The method of claim **8** further comprising the steps of:

receiving a second command file from a host system in said network subsequent to said step of updating said display;

executing said second command file in the client system; and

further updating said display in response to said step of executing said second command file.

10. The method of claim **9**, wherein one of said one or more server systems comprises said host computer system.

11. The method of claim **8**, wherein each of said one or more child frames is associated with a corresponding command file located on a respective one of said one or more servers in the network.

12. The method of claim **11**, wherein said child frames are not visible in said display.

13. The method of claim **1**, wherein the network comprises a member of the group consisting of an intranet and the Internet.

14. The method of claim **1**, wherein the client system comprises one of said one or more server systems.

15. The method of claim **14**, wherein said client system further comprises a host computer system.

16. The method of claim **1**, wherein one of said one or more server systems comprises a server system which executes the plurality of requests in a multithreaded environment.

17. The method of claim **1**, wherein each of said plurality of requests comprises an identifier associated with a particular user name identifying a user of each of said plurality of notes conferences.

* * * * *